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Tai chi for cardiovascular disease and its risk factors: a systematic review
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Cardiovascular disease (CVD) is a leading cause of morbidity and mortality and is responsible for one in three deaths [1]. Mind–body interventions such as tai chi are complementary therapies that are frequently used [2]. Tai chi may have some benefit in preventing or treating CVD. The objective of this systematic review and meta-analysis was to assess the evidence of tai chi for CVD and its risk factors.

Databases searched from their respective inceptions through to March 2007 were: MEDLINE, AMED, British Nursing Index, CINAHL, EMBASE, PsycINFO, the Clinical Trials.gov of the National Institute of Health and National Research Register, Korean Medical Databases, Chinese Academic Journals Databases (CNKI), and the Cochrane Library 2007, issue 1. There were no language restrictions. The search terms used were: ‘taichi’, ‘tai adj chi’ or ‘tai chi chun’ and ‘cardiovascular’, ‘heart’, ‘stroke’, ‘myocardial infarction’, ‘peripheral arterial occlusive disease’, ‘hypertension’, ‘diabetes’, ‘obesity’, ‘physical inactivity’, ‘stress’, ‘cholesterol’ or ‘smoking’. In addition, the references of all located articles and the proceedings of the 1st International Conference of Tai Chi for Health (December 2006, Seoul, South Korea) were hand-searched for further relevant articles.

Prospective, randomized, controlled clinical trials of tai chi for CVD or any of its risk factors were included. Trials comparing tai chi with any type of control group were included. A modified Jadad score was used [3] whereby a point was given for blinding if the outcome assessor was blinded. The mean change in blood pressure compared with baseline was defined as the primary endpoint, and was used to assess the difference between the intervention groups and control groups.

The literature searches identified 164 potentially relevant studies of which nine randomized, controlled trials (RCTs) were included (Table 1). One ongoing RCT, which is funded by the National Center for Complementary and Alternative Medicine, tests tai chi for chronic heart failure compared with an education programme.

<table>
<thead>
<tr>
<th>First author</th>
<th>Conditions</th>
<th>sample size (randomized/analysed)</th>
<th>Jadad score, allocation concealment</th>
<th>Control intervention</th>
<th>Main outcome measure</th>
<th>Intergroup differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channer [11]</td>
<td>Acute myocardial infarction 126/65</td>
<td>2, n.r.</td>
<td>(A) Aerobic exercise (1) SBP and DBP (2) HR</td>
<td>Tai chi vs (A) (B) Non-exercise support</td>
<td>P &lt; 0.001</td>
<td></td>
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<tr>
<td>Young [6]</td>
<td>Hypertension 62/60</td>
<td>4, n.r., AB</td>
<td>Aerobic exercise</td>
<td>(1) SBP and DBP (2) Maximal aerobic capacity</td>
<td>(1), (2) NS</td>
<td></td>
</tr>
<tr>
<td>Tsai [4]</td>
<td>Hypertension 88/76</td>
<td>4, n.r., AB</td>
<td>No treatment</td>
<td>(1) SBP and DBP (2) Lipid profile</td>
<td>n.r.</td>
<td></td>
</tr>
<tr>
<td>Hart [7]</td>
<td>Stroke 18/n.r.</td>
<td>2, n.r., AB</td>
<td>Group balancing exercises</td>
<td>(1) Balance test (2) Speed of walking</td>
<td>P &lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>Lee [8]</td>
<td>Hypertension 50/28</td>
<td>2, n.r.</td>
<td>No treatment</td>
<td>(1) SBP and DBP (2) Total cholesterol</td>
<td>(1) SBP, P &lt; 0.004; DBP, P &lt; 0.001 (2) NS</td>
<td></td>
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<tr>
<td>Yeh [5]</td>
<td>Chronic heart failure 30/30</td>
<td>3, adequate</td>
<td>Usual care</td>
<td>(1) Quality of life (2) 6-Min walking distance (3) Incidence of arrhythmia</td>
<td>P &lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>Wen [10]</td>
<td>Hypertension 36/n.r.</td>
<td>1, n.r.</td>
<td>No treatment</td>
<td>(1) SBP and DBP (2) HR</td>
<td>(1) SBP, P &lt; 0.05; DBP, P &lt; 0.05 (2) NS</td>
<td></td>
</tr>
<tr>
<td>Orr [12]</td>
<td>Type 2 diabetes 38/35</td>
<td>1, n.r.</td>
<td>Sham exercise</td>
<td>(1) Mobility (2) Gait speed</td>
<td>(1), (2) NS</td>
<td></td>
</tr>
<tr>
<td>Mao [9]</td>
<td>Hypertension 62/62</td>
<td>2, n.r.</td>
<td>No treatment</td>
<td>(1) SBP and DBP (2) Nitric oxide</td>
<td>(1) SBP, P &lt; 0.01; DBP, P &lt; 0.01 (2) P &lt; 0.01</td>
<td></td>
</tr>
</tbody>
</table>

AB, assessor blind; DBP, Diastolic blood pressure; HR, heart rate; n.r., not reported; NS, no significant difference; SBP, systolic blood pressure.
Of the nine included RCTs, three described the methods of randomization [4–6] and three described assessor blinding [4,6,7]. Only one trial reported details on allocation concealment [5]. Four studies [4,8–10] suggested significant blood pressure reduction in hypertensive patients compared with no treatment \( n = 166 \), weighted mean difference (mmHg), systolic blood pressure (SBP) \( -21.48, 95\% \) confidence interval (CI) \( -25.83 \) to \( -17.13, P < 0.001 \), heterogeneity \( \chi^2 = 0.43, P = 0.81, I^2 = 0\% \); and diastolic blood pressure (DBP) \( -12.05, 95\% \) CI \( -15.31 \) to \( -8.78, P < 0.001 \), heterogeneity \( \chi^2 = 0.02, P = 0.99, I^2 = 0\% \). Two RCTs compared tai chi with aerobic exercise in patients with hypertension [6] or acute myocardial infarction [11].

There is some evidence from RCTs suggesting blood pressure reduction in patients with hypertension. The effects observed, compared with no treatment, may suggest effectiveness against the natural course of disease, but provides little information about any specific effects [4,8–10]. Whether the findings of no difference compared with aerobic exercise reflects equivalence of effects is as yet unclear. For other CVD such as stroke and chronic heart failure there is also some indication that tai chi may be helpful. None of the reviewed trials reported any adverse events.

The limitations of our systematic review, and indeed systematic review in general, pertain to the potential incompleteness of the evidence reviewed [13,14]. We are confident, however, that our search strategy has located all relevant data on the subject. In this systematic review there were no restrictions in terms of publication language and a large number of different databases were searched.

In conclusion, the evidence on tai chi for CVD and its risk factors is scarce. For hypertension the evidence is encouraging, suggesting potential effectiveness. The number of trials and the total sample sizes are, however, too small to draw any firm conclusions.

Acknowledgements
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Evolution of blood pressure control in Spain
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Hypertension is very prevalent in industrialized countries. In the United States it is estimated that more than a quarter of the population has hypertension [1]. In Spain, it is responsible for approximately one out of four total deaths and one out of 2.5 cardiovascular deaths [2]. Blood pressure control is crucial in the prevention of cardiovascular disease, and blood pressure lowering appears critical in reducing the risk of cardiovascular outcomes and preventing major coronary events [3,4]. Even small blood pressure decreases imply a significant reduction in adverse outcomes [5]. The better blood pressure control attained in Spain in the past decade has thus reduced the incidence of stroke [6]. Studies suggest that although hypertension is underdiagnosed and undertreated, there has been an improvement in blood pressure control rates in Europe and the United States [1,7].
Studies carried out in the early 1990s in Spain on blood pressure control showed a very low proportion of patients achieving blood pressure goals. This may have very important implications, taking into account that at present the majority of patients with hypertension seen daily in outpatient clinics, not only in specialist settings but also in primary care, belong to the medium or high coronary risk groups [8]. As a result, some strategies have been developed to raise physician and patient awareness about the importance of blood pressure control, mainly through continuous medical education. In the past 15 years, several population-based studies and clinical practice surveys have focused on blood pressure control in the Spanish population, and have recently shown a progressive improvement, from only approximately 15% of blood pressure control among treated hypertensive patients in the early 1990s to 30–40% now [9–16]. This improvement is even more relevant, taking into account that in the past few years the thresholds for blood pressure control have lowered [17].

More specifically, blood pressure control among treated hypertensive patients in the Spanish primary care setting was 13% in 1995, 36.1% in 2001, and 38.8% in 2003 [15], and in the specialized setting (hospital-based hypertensive units) it was 42% in 2001 and 47% in 2004 [16]. Finally, in samples representative of the adult non-institutionalized general population, blood pressure control among treated hypertensive patients increased from 16% in 1990 to 29% in 2001 [8,14]. A recent study has also shown that blood pressure control in adult treated hypertensive patients based on ambulatory blood pressure monitoring (50%) is much better than blood pressure control as measured in the office [18]. Therefore, blood pressure control in Spain, probably as in other developed countries, is better than previously believed.

An improvement in blood pressure control has been shown in most western European countries and in the United States, but also in Spain [1,7]. Although the prevalence of hypertension has not changed in the United States during the past 5 years, blood pressure control rates have increased from 29.2% in 1999–2000 to 36.8% in 2003–2004 [1]. Some potential explanations for the improvement in blood pressure control in Spain may be related to better knowledge and adherence to hypertension guidelines and the major concern about this important public health problem [19,20].

Although these data are hopeful, however, it must not be forgotten that at best more than 50% of patients with hypertension are undercontrolled in Spain. Therapeutic inertia, an underestimation of cardiovascular risk in the hypertensive population, the great misperception that physicians and patients have about patient blood pressure control rates, the difficulty in achieving blood pressure objectives, the underrating of systolic blood pressure, and the low use of combined therapy and therapeutic compliance are some of the deficiencies that may be improved in the next few years [19–21].

References

A case of pheochromocytoma symptomatic after delivery
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A hormone-secreting adrenal mass as a cause of secondary hypertension is a rather rare condition [1,2]. The correct diagnosis of endocrine hypertension remains a difficult task. As outlined by Manger [3], a large proportion of pheochromocytomas are only discovered at autopsy, because this tumour is often not suspected. In this context, we report the case of a 34-year-old woman who delivered her first child after an uneventful term pregnancy. Blood pressure during pregnancy never exceeded 135/85 mmHg. The patient never suffered from sweating, headache or palpitations during her pregnancy. She had no history of medical disease, and also there was no family history of hypertension or endocrine disease. Before her pregnancy, however, she occasionally complained of dizziness and headaches, but never sought medical advice for this. Three day after the uncomplicated delivery of a healthy newborn the patient suddenly developed severe hypertension, with blood pressure levels up to 290/140 mmHg, accompanied by headache and nausea. Abdominal ultrasound revealed a left adrenal mass. Urinary norepinephrine excretion was 479 mg/24 h, urinary epinephrine excretion was 271 mg/24 h, thus more than fivefold, respectively 10-fold elevated. I-123 MIBG scintigraphy revealed intense tracer accumulation in the left adrenal region, consistent with a pheochromocytoma. There were no further lesions. Genetic analysis did not reveal any mutations of the VHL, SDHB, SDHD or RET genes nor deletions of the VHL gene. Furthermore, thyroid ultrasound and analysis of serum calcitonin and parathyroid hormone did not reveal any abnormalities. The patient’s blood pressure was controlled by phenoxybenzamine, later on in combination with metoprolol. Three weeks later the left adrenal gland with a pheochromocytoma of 5 cm in size was surgically removed. After surgery, the patient was normotensive and did not require any antihypertensive medication.

A phaeochromocytoma diagnosed in pregnancy is a rare condition [4]. Published case reports describe pheochromocytomas mimicking severe pre-eclampsia or causing hypertensive emergencies during delivery [4]. The patient reported here, however, developed symptoms only 3 days after delivery despite a large pheochromocytoma. The initial likelihood of pheochromocytoma in this case of postpartum hypertension was low. The rapid and consequent diagnostic evaluation of an adrenal mass during pregnancy or postpartum is mandatory because pheochromocytoma-related hypertensive emergencies during pregnancy and delivery have a grim prognosis, as shown by the published case of a woman diagnosed on autopsy [5].

References